

NON-PUBLIC?: N
ACCESSION #: 8711190362
LICENSEE EVENT REPORT (LER)

FACILITY NAME: D. C. Cook Nuclear Plant - Unit 1 PAGE: 1 of 5

DOCKET NUMBER: 05000315

TITLE: ESF Actuation (Reactor Trip) Due to Feedwater Flow/Steam Flow Mismatch
Coincident With Low Steam Generator Level Resulting From Component
Failure

EVENT DATE: 10/13/87 LER #: 87-021-00 REPORT DATE: 11/12/87

POWER LEVEL: 069

LICENSEE CONTACT FOR THIS LER:

NAME: J. R. Sampson - Safety and Assessment Superintendent
TELEPHONE #: 616-465-5901

COMPONENT FAILURE DESCRIPTION:

CAUSE: X SYSTEM: JK COMPONENT: NA MANUFACTURER: G080
REPORTABLE TO NPRDS: Y

CAUSE: X SYSTEM: JK COMPONENT: GR MANUFACTURER: G080
REPORTABLE TO NPRDS: Y

CAUSE: X SYSTEM: JK COMPONENT: NA MANUFACTURER: G080
REPORTABLE TO NPRDS: Y

CAUSE: X SYSTEM: JK COMPONENT: GR MANUFACTURER: G080
REPORTABLE TO NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT: On October 13, 1987, at 0818 hours, an Engineered Safety Features actuation (Reactor Trip) occurred due to a feedwater flow/steam flow mismatch coincident with low level on steam generator number 11.

At approximately 0817 hours, a licensed operator removed the east main feedwater pump alternating current auxiliary oil pump from service as directed by procedure. The shaft driven oil pump failed to maintain control oil pressure as expected. This resulted in a main feedwater system transient which culminated in the reactor trip.

Post-event evaluation identified no component failure, other than the shaft-driven oil pump, which significantly affected the event. The east main feedwater pump shaft driven oil pump was found to be damaged. It was repaired and the feedwater pump was returned to service.

(End of Abstract)

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Conditions Prior to Occurrence

Unit 1 was in Mode 1 (Power Operation) and at 69 percent reactor thermal power (RTP).

Description of Event

On October 13, 1987, at 0818 hours, an Engineered Safety Features actuation (Reactor Trip) occurred due to a feedwater flow/steam flow mismatch on steam generator (EIIS/AB-SG) number 11 coincident with low level on steam generator number 11. At the time of the trip, the unit was experiencing a feedwater transient initiated by the failure of the east main feedwater pump shaft driven oil pump (EIIS/JK-P) to maintain adequate control oil pressure as expected, when the east main feedwater pump's (EIIS/SJ-P) alternating current (A.C.) auxiliary electric oil pump (EIIS/JK-P) was secured.

At approximately 0817 hours, a licensed senior reactor operator removed the A.C. auxiliary oil pump associated with the in service East main feedwater pump from service, as directed by procedure. The east main feedwater pump speed was approximately 4100 revolutions per minute (R.P.M.). At this speed, the shaft driven oil pump is expected to maintain lubricating and control oil pressure. Due to internal damage, the shaft driven oil pump was unable to maintain pressure. When lubricating and control oil pressure decreased, the operator promptly restarted the A.C. oil pump. To compensate for decreasing

east main feedwater pump speed, the feedwater regulating valves (FRVs) (EIIS/JB-FCV) were manually placed in the fully opened position and the speed of the west main feedwater pump was manually increased. Attempts were made to increase east main feedwater pump speed. At this point some progress had been made in restoring feedwater flow to the steam generators, however the east main feedwater pump isolation valve (EIIS/SJ-ISV), which had been running shut, reached the fully closed position aggravating the feedwater transient and resulting in the reactor trip signal from a low steam generator level coincident with feedwater flow/steam flow mismatch.

Following the trip sequence (opening of the reactor trip breakers (EIIS/JE-BKR), turbine (EIIS/TA-TRB) trip, insertion of the reactor control rods (EIIS-/AA-ROD), feedwater isolation (EIIS/JB), automatic starting of the motor-driven and turbine-driven auxiliary feedwater pumps (EIIS/BA-P)) Operations personnel immediately implemented the Emergency Operating Procedure 1-OHP 4023.E-0 to verify proper response of the automatic protection system (EIIS/JC) and to assess plant conditions for initiating appropriate recovery

actions. There was no automatic or manual actuation of the safety injection system (EIIS/BQ).

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The unit was stabilized in Mode 3 (Hot Standby) at approximately 0903 hours, October 13, 1987. The Nuclear Regulatory Commission was notified of the event via the Emergency Notification System at 0904 hours.

With the exception of the east main feedwater pump shaft driven oil pump, there were no inoperative structures, components, or systems that contributed significantly to this event.

Cause of Event

The cause of this event was determined to be failure of the east main feedwater pump shaft driven oil pump. Internal damage to this pump resulted in its inability to maintain lubricating and control oil pressure when the associated A.C. auxiliary oil pump was secured. When the oil pressure decreased, the east main feedpump turbine stop valves (EIIS/JK-SHV) went closed, causing the east main feedpump governor (EIIS/JK-65) to run back and the feedpump discharge valve to close. The resulting decrease in feedwater flow, coincident with a low level in number 11 steam generator, generated the reactor trip signal.

Analysis of Event

This Engineered Safety Features actuation, which resulted in a reactor trip sequence, is reportable pursuant to 10 CFR 50.73 (a)(2)(iv).

Following the trip, various components of the east main feedpump turbine oil system (EIIS/JK) were inspected in order to determine the cause of the failure to maintain oil pressure. The shaft oil pump, oil pump suction strainers (EIIS/JK-STR) and check valves (EIIS/JK-V), pressure regulating valve (EIIS/JK-PCV), and auxiliary oil pump check valve (EIIS/JK-V) were inspected. It was found that the pump upper shaft low pressure bearing thrust plate (EIIS/JK) had foreign object damage and the middle journal bearings (EIIS/JK) (upper and lower shaft) were partially wiped. The pump upper shaft low pressure gear (EIIS/JK-GR) was also found damaged. Beyond the fact that the bearings had gotten hot, the specific cause of the damage could not be firmly established.

During the feedwater transient, the behavior of the east main feedwater pump and its discharge valve was as expected under the circumstances. Loss of control oil pressure caused the feedpump turbine stop valves to go closed, picking up limit switches (EIIS/JK-33). These limit switches caused

governor/speed changer to run back. Because of this, east main feedwater pump speed continued to decrease, even though the pump had not tripped and control oil pressure had been restored. The same limit switches also caused the feedwater pump discharge valve to run closed, shutting off feedwater flow from the affected pump.

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During the post-trip review, and based on licensed Operator comments and a computer printout, it appeared that the feedwater flow/steam flow mismatch coincident with low steam generator level trip signal may have actuated at a value of steam generator level above (the conservative direction) the expected trip value. Instrumentation and Control Section checkout of the bistable setpoints confirmed accurate and proper bistable operation and satisfactory control room meter (EIIS/JB-MTR) indication accuracy.

The automatic protection system responses, including reactor trip and its associated actuations, were verified to have functioned properly as a result of the engineered safety features actuation. Based on the above, it is concluded that the event did not constitute an unreviewed safety question as defined in 10 CFR 50.59 (a)(2) nor did it adversely impact the health and safety of the public.

Corrective Actions

Immediate corrective action involved Operations personnel implementing plant procedures to verify proper response of the automatic protection system and to assess plant conditions for initiation of appropriate recovery actions. To repair the damage observed on the east main feedpump shaft driven oil pump, the middle journal bearings (upper and lower shaft) were replaced with spares and a new set of low pressure pump gears was installed. The east main feedpump turbine was brought up to speed on the morning of October 18, 1987 and the shaft-driven oil pump successfully held pressure.

Failed Component Identification

In order to repair damage observed in the east main feedpump shaft driven oil pump, the following components were replaced:

Plant Description: Bearing-Shaft Drive Oil pp BFPT
Manufacturer: General Electric
Manufacturer's ID Number: GE #101 C286FD-1
EIIS Code: EIIS/JK
Number Replaced: 2

Plant Description: Bearing-Shaft Drive Oil pp BFPT

Manufacturer: General Electric
Manufacturer's ID Number: GE #101 C286 FC-1
EHS Code: EHS/JK
Number Replaced: 2

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Plant Description: Gear-Shaft Drive Oil pp BFPT
Manufacturer: General Electric
Manufacturer's ID Number: GE #134 B 230 BF-1
EHS Code: EHS/JK-GR
Number Replaced: 1

Plant Description: Gear-Shaft Drive oil pump
Manufacturer: General Electric
Manufacturer's ID Number: GE #134 B 230 BF-2
EHS Code: EHS/JK-GR
Number Replaced: 1

Previous Similar Events

None - No previous similar events involving the malfunction of the main feedwater pump shaft driven oil pump were identified.

ATTACHMENT # 1 TO ANO # 8711190362 PAGE: 1 of 1

Indiana Michigan
Power Company
Cook Nuclear Plant
P.O. Box 458
Bridgman, MI 49106
616 465 5901 AEP

INDIANA MICHIGAN POWER

November 12, 1987

United States Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Operating License DPR-58
Docket No. 50-315

Document Control Manager:

In accordance with the criteria established by 10 CFR 50.73 entitled Licensee Event Reporting System, the following report is being submitted:

87-021-0

Sincerely,

/s/ W. G. Smith, Jr.
W. G. Smith, Jr.
Plant Manager

WGS/afh

Attachment

cc: John E. Dolan
A. B. Davis, Region III
M. P. Alexich
R. F. Kroeger
H. B. Brugger
R. W. Jurgensen
NRC Resident Inspector
R. C. Callen
G. Charnoff, Esq.
D. Hahn
INPO
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